AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.10.2.1

Life cycle assessment

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**3**
Available paper years	**2018–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

5.10.2.1 Life cycle assessment

Answer 01 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	condenses		1	AO1 5.7.1.2
06.2	the fractions have different boiling points		1	AO1 5.7.1.2 5.7.1.3
06.3	propane	do **not** accept propene	1	AO2 5.7.1.1
06.4	C_nH_{2n+2}		1	AO1 5.7.1.1
06.5	$CH_4 + \mathbf{2}\ O_2 \rightarrow CO_2 + \mathbf{2}\ H_2O$	allow multiples	1	AO2 5.1.1.1 5.7.1.3
06.6	bromine water		1	AO1 5.7.1.4
06.7	to assess the environmental impact (of the stages in the life of a product)	allow to see the effect / harm / damage on the Earth / environment / planet ignore references to energy, pollution, carbon footprint, carbon dioxide, sustainability	1	AO1 5.10.2.1

5.10.2.1 Life cycle assessment

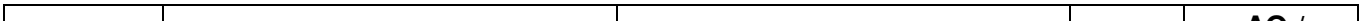
Answer 01 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
06.8	**Level 2:** Scientifically relevant features are identified; the ways in which they are similar / different is made clear and the magnitude of the similarity / difference noted.	3–4	AO3
	Level 1: Relevant features are identified and differences noted.	1–2	AO2
	No relevant content	0	
	Indicative content • burning 10 000 bags produces 10 kg more of carbon dioxide than landfill • putting 10 000 bags in landfill produces 0.02 kg more of solid residue than burning. • putting 10 000 bags in landfill produces 50% more sulfur dioxide than burning • burning 10 000 bags produces 25 kg of carbon dioxide, but landfill only produces15 kg • putting 10 000 bags in landfill produces 0.07 kg of solid residue but burning only produces 0.05 kg • landfill produces less carbon dioxide than burning • landfill produces more solid residue than burning • burning produces less sulfur dioxide than landfill		5.10.2.1 5.10.2.2 5.9.2.2
Total			**11**

5.10.2.1 Life cycle assessment

Answer 01 · Mark scheme

June 2018 | 8464/C/2F | Original Q6



5.10.2.1 Life cycle assessment

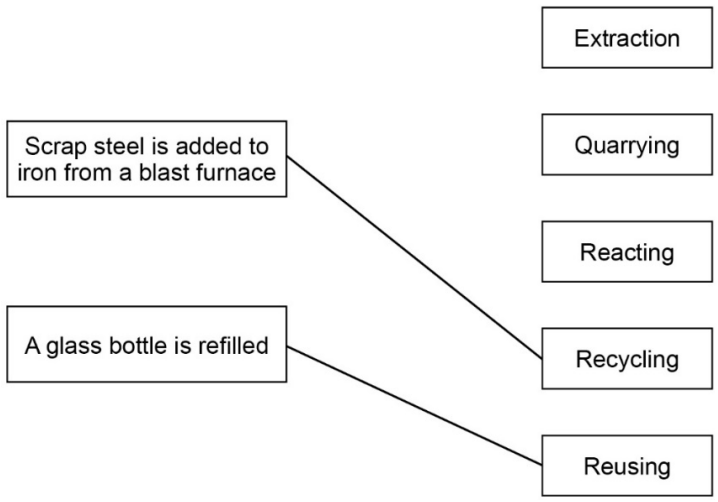
Answer 02 · Mark scheme

November 2021 | 8464/C/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	as population increased, copper production increased		1	AO3 5.10.1.1
05.2	(copper ore) (70 × 100 =) 7000 (recycled copper) (27×100 =) 2700 (7000 – 2700 =) 4300 (MJ)	 allow correct use of incorrectly determined values for MP1 (copper ore) and/or MP2 (recycled copper)	1 1 1	AO2 5.10.2.2
05.3	any **one** from: • reduces acid rain • reduces respiratory problems (in humans)	 allow sulfur dioxide causes acid rain allow sulfur dioxide causes respiratory problems (in humans)	1	AO1 5.9.3.2
05.4	$\frac{75}{100}$ × 8 = 6 (g)		1 1	AO2 5.10.1.1

5.10.2.1 Life cycle assessment

Answer 02 · Mark scheme

05.5	 do **not** accept more than one line from a box on the left		1 1	AO2 5.10.2.2
05.6	**B**, **C**, **D**, **A**		1	AO1 5.10.2.2
Total			**10**	

5.10.2.1 Life cycle assessment

Answer 02 · Mark scheme

November 2021 | 8464/C/2F | Original Q5

5.10.2.1 Life cycle assessment

Answer 03 · Mark scheme June 2024 | 8464/C/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(mass of aluminium recycled =) $\frac{212 \times 68.0}{100}$		1	AO2 5.10.2.1 5.10.2.2
	= 144 (million kg)	allow 144.16 (million kg) allow for **1** mark only an answer of 144 000 000 (million kg) **or** 144 160 000 (million kg)	1	

5.10.2.1 Life cycle assessment

Answer 03 · Mark scheme

June 2024 | 8464/C/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(unit conversion 4 kg =) 4000 g		1	AO2 5.10.2.2
	(number of cans =) $\frac{4000}{15.8}$	allow correct use of an incorrect / no conversion	1	
	= 253.16		1	
	= 253	allow correct whole number from an incorrectly determined number of cans using the values from the question	1	
	alternative approach 1			
	(unit conversion 15.8 g =) 0.0158 kg (1)			
	(number of cans =) $\frac{4}{0.0158}$ (1)	allow correct use of an incorrect / no conversion		
	= 253.16 (1)			
	= 253 (1)	allow correct whole number from an incorrectly determined number of cans using the values from the question		
	alternative approach 2			
	(number of cans from 1000 g =) $\frac{1000}{15.8}$ (1)			
	= 63.29 (1)			
	(number of cans from 4000 g) = 63.29 × 4 (1)	allow correct use of an incorrectly determined number of cans from 1000 g		
	(= 253.16) = 253 (1)	allow correct whole number from an incorrectly determined number of cans using the values from the question		

5.10.2.1 Life cycle assessment

Answer 03 · Mark scheme

June 2024 | 8464/C/2F | Original Q5

Question	Answers	Mark	AO / Spec. Ref.
05.3	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 5.10.2.1 5.10.2.2
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content • less steel (than wood) goes to waste • (so) less space taken up in landfill • more steel (than wood) is recycled • (so) less non-renewable resources are needed • no steel is burnt • (so) no carbon dioxide produced • (so) no contribution to climate change • most wood is disposed of as waste • (so) more space taken up in landfill • least wood is disposed of by burning • (but) still produces carbon dioxide • (which) contributes to climate change • most steel is disposed of by recycling • (so) less non-renewable resources are needed • judgement		

Total Question 5	**10**

5.10.2.1 Life cycle assessment

Answer 02 · Examiner comments — November 2021 | 8464/C/2F | Original Q5

Question 5 (low and standard demand)

The interpretation of data and the associated calculations were generally well done, and many students scored highly on this question. The exception was question 05.3, where no credit was given for sulfur dioxide being toxic or harmful, as these are not the most significant reasons for reducing the global emissions of the gas.

Answer 03 · Examiner comments — June 2024 | 8464/C/2F | Original Q5

Question 5 (low & standard demand)

05.1 This calculation proved accessible to many students, with over half gaining at least 1 mark.

A common error included unnecessary unit conversions, particularly multiplying by 1 000 000, but such students could still get the compensation mark. Failure to divide by 100 for the percentage often appeared, meaning no credit could be given. Many students divided 212 by 68% rather than multiplying them together.

A few students coincidentally arrived at the correct numerical value by incorrectly subtracting, 212 – 68 = 144, but this gained no credit.

05.2 Although unfamiliar, this AO2 calculation was well attempted by many students, with just over 50% gaining full marks.

For marking point 1 incorrect conversions, such as 15.8 × 1000, or 4 ÷ 1000, were commonplace although marks could still be awarded consequentially. Some students inappropriately rounded 15.8 to 16 and used this in their calculations, which meant marking points 2 and 3 could not be awarded. Marking point 4 was often missed by students rounding up instead of down, or not reading the question properly and leaving a decimal point in their final answer.

All the alternative mathematical methods on the mark scheme were used in arriving at the right answer. Some students arrived at the correct answer by simply scaling up 15.8 many times until they got to (eg) 253 cans = 3997.4 g and 254 cans = 4013.2 g, then correctly choosing the lower value. Simple incorrect use of the values (eg 15.8 × 4) was seen, giving an answer of 63.2 which could not gain credit, but the consequential whole number of 63 cans could be awarded marking point 4 because the values in the question had been used.

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5.10.2.1 Life cycle assessment

Answer 03 · Examiner comments June 2024 | 8464/C/2F | Original Q5

05.3 Fewer than 10% of students were able to achieve marks in Level 2 on this AO3 extended response evaluation question. To access marks in Level 2 students needed to provide a judgement supported by appropriate comparisons and links.

Simply repeating data from the table without interpretation or using it was common and was not credited.

Most comparisons were made between steel and wood, but also comparisons made horizontally across the table (eg most wood is wasted) were quite common. Some solid answers with more than one link were lacking in a judgement, which did not address the command word and so were restricted to Level 1.

Judgements were often muddled by describing both wood and steel as sustainable 'because they're both recycled', failing to see the advantage of steel. Wasting wood was often considered to be a good thing as it could be used for animal habitats, or because it rots back into the ground and burning wood was seen as a good thing since it is a good fuel. Imprecise language such as 'steel can be re-used' (rather than 're-cycled') was often used.

Of the links, carbon dioxide and climate change was most used; landfill descriptions were a rarity and no mention was seen of conserving non-renewable resources.

0 5 . 3 **Table 5** shows three methods used to dispose of wood and steel after use.

Table 5

	Percentage (%) of material disposed of by each method		
	As waste	Recycled	Burnt
Wood	58	36	6
Steel	15	85	0

Evaluate the sustainability of the disposal of wood and steel.

[4 marks]

Steel is more sustainable than wood as the table shows it is recycled more and less put into waste

Despite making a judgement in their opening sentence and then going on to make two valid comparisons ('it [steel] is recycled more' and 'less put into waste'), this student has not made any links so is limited to the top of Level 1 and gains 2 marks.

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5.10.2.1 Life cycle assessment

Answer 03 · Examiner comments June 2024 | 8464/C/2F | Original Q5

0 5 . 3 **Table 5** shows three methods used to dispose of wood and steel after use.

Table 5

	Percentage (%) of material disposed of by each method		
	As waste	Recycled	Burnt
Wood	58	36	6
Steel	15	85	0

Evaluate the sustainability of the disposal of wood and steel.

[4 marks]

~~out of 100 only 58%~~
~~of w~~ 58% of wood wasted.
36% Recycled and put to use
6% burned which Releases
CO_2 which is a greenhouse
gas, contributing to global
warming

only 15% steel waste as its
hard to Dispose off

In this response, the student is quoting numbers from the table without adding anything, which is not creditworthy; however, they have made a link to burning wood releases carbon dioxide which is a greenhouse gas. There is no judgement given and no comparisons, which are required to access Level 2, so this response is at the top of Level 1 and gains 2 marks.

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5.10.2.1 Life cycle assessment

Answer 03 · Examiner comments June 2024 | 8464/C/2F | Original Q5

0 5 . 3 **Table 5** shows three methods used to dispose of wood and steel after use.

Table 5

	Percentage (%) of material disposed of by each method		
	As waste	Recycled	Burnt
Wood	58	36	6
Steel	15	85	0

Evaluate the sustainability of the disposal of wood and steel.

[4 marks]

The sustainability of wood and steel is wood as 58% of waste, 36% recycled and 6% burnt. Steel has 15% waste, 85% recycled, 0% burnt so steel would be more sustainably as there less of it.

This student has only quoted numbers from the table, again not doing anything with them, which is not creditworthy. The final sentence is a judgement; however, it is not logically supported so is also not creditworthy. This response gained no marks.